

Serial No. 10/047,239

PU020018

Remarks/Arguments

Claim Rejections -35 USC 103

Item 2

In the Final Office Action, all pending claims 1, 3, 5, 9 and 10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Description of Related Art in the background of the instant application in view of Jaffe et al. (U.S. 6,198,211 B1).

Remarks for Claim 1

Applicants amend independent claim 1 such that the imager 212 is an "LCOS imager." Independent claim 1 is directed to a projection type display unit including at least one LCOS imager 212; at least one red resonant microcavity cathode-ray tube 204, at least one green resonant microcavity cathode-ray tube 206, and at least one blue resonant microcavity cathode-ray tube 208; and a projection lens 214. (See Applicants' specification at Fig. 2; page 5, lines 11-23; and page 7, line 25 to page 8, line 9.) The LCOS imager 212 includes an array of pixels individually controlled with video signal to form an image by passing the red, green and blue light through the pixels. (See Applicants' specification at Fig. 2, page 5, lines 11-14 and, page 8, lines 3-9.) The red, green, and blue resonant microcavity cathode-ray tubes 204, 206, 208 emit red, green, and blue light and these resonant microcavity cathode-ray tubes 204, 206, 208 are optically coupled to the imager 212. (See Applicants' specification at Fig. 2 and page 7, line 28 to page 8, line 9.) The projector lens 214 (which is represented by the 8-sided polygon in Fig. 2) is optically coupled to the LCOS imager 212 for magnifying and focusing the image for projection on a screen. (See Applicants' specification at Fig. 2; page 8, lines 5-9.)

Jaffe describes numerous types of resonant microcavity displays (RMDs) and generally characterizes RMDs as "any structure that modifies spontaneous emission properties of a phosphor contained within the structure ..." such that it is "possible to suppress emission in certain optical modes ..." and "the phosphor favorably emits into a relatively few optical modes...." (See Jaffe at col. 4, lines 48-59.) Jaffe discloses that

the phosphor in RMDs "may be excited through several means including: bombardment by externally generated electrons (cathodoluminescence), excitation by electrodes placed across the active layer to create an electric field (electroluminescence), or excitation using photons (photoluminescence). (See Jaffe at col. 5, line 65 to col. 6, line 3.)

Jaffe discloses 21 different embodiments of RMDs according to the invention therein. These embodiments are generally described in Figs. 1-10 and 12-23 and in col. 7, line 58 to col. 9, line 4. One embodiment of the invention is shown in each of the following figures in Jaffe: Figs. 1-7 and 10 and Figs. 14-23. Figs. 8 and 9 together show one embodiment. Figs. 12, 13a and 13b together show one embodiment.

In Jaffe, the only examples of RMDs which are characterized as being usable in CRTs are the ones showing the monochromatic CRT 100 in Figs. 8-9 (col. 14, lines 45-53) and showing the full color CRT 120 in Fig. 12-13b (see col. 15, lines 27-45). In Jaffe, the CRT 120 in Fig. 12 is described as being used in direct view television. (See Jaffe, col. 15, lines 27-35.) It is only these two RMDs 100, 120 that have any relevance to Applicants' invention because these are the only RMDs that have electron guns and have electron beams that scan on a screen. All other RMDs disclosed in Jaffe are completely different RMD types, and as such, are irrelevant to Applicants' claimed invention. The other RMDs are completely different devices than RMD CRTs because they do not have electron guns and they are generally addressed, as opposed to scanning electrons. (The RMD shown in Fig. 21 of Jaffe and discussed in col. 19, lines 7-10, scans a laser beam.)

Applicants' claim 1 includes, *inter alia*, the element "at least one red resonant microcavity cathode-ray tube 204, at least one green resonant microcavity cathode-ray tube 206, and at least one blue resonant microcavity cathode-ray tube 208 coupled to said LCOS imager."

Jaffe does not disclose a projection type display unit including at least one red resonant microcavity cathode-ray tube 204, at least one green resonant microcavity cathode-ray tube 206, and at least one blue resonant microcavity cathode-ray tube 208 coupled to an LCOS imager nor any LCD imager for a projection display. Rather, Jaffe points out (1) that conventional full color projection televisions require three separate CRTs for each primary color and (2) RMD CRTs (resonant microcavity cathode-ray tubes) are superior CRTs because they allow intense excitation and compact CRTs. (See

Serial No. 10/047,239

PU020018

Jaffe, col. 13, lines 13-19.) As such, Jaffe asserts that RMD CRTs can replace CRTs as the source in CRT projection displays, because an RMD CRTs "allows for intense excitation loading of the phosphor, highly directional output, controlled chromaticity, and high external efficiency." Jaffe, however, does not assert the coupling of a RMD CRTs (resonant microcavity cathode-ray tubes) with any LCD or LCOS device and replacing the conventional CRT in a CRT projection display with the RMD CRT-LCD or LCOS couple.

Further, the only LCD devices incorporating RMDs in Jaffe are flat panel displays. (See Jaffe, col. 20, lines 46-56.) Flat panel displays in this context are direct view LCD panels, and not projection displays. In fact, an example LCD device given by Jaffe teaches the use of RMDs that are not RMD CRTs, but are, instead, electro-optic or piezo-electric type RMDs shown in Fig. 22 of Jaffe (col. 19, line 56 to col. 20, line 5) and plasma discharge type RMDs shown in Fig. 23 of Jaffe (col. 21, lines 21-34). Electro-optic or piezo-electric type RMDs and plasma discharge type RMDs are completely different than RMD CRTs (which is a limitation in Applicants' amended claim 1) and the electro-optic or piezo-electric type RMDs and plasma discharge type RMDs should be thinner than RMD CRTs, because RMD CRTs require a glass vacuum tube enclosing an electron gun (col. 14, lines 45-53) and must scan "an electron beam to write the information to the luminescent screen." (See Jaffe, col. 4, lines 32-34.)

Applicants further point out that Jaffe teaches the use of light valves (such as those used in LCDs) to modulate light intensity generated by RMDs that operate as "a switch by turning the light completely on and completely off." (See Jaffe, col. 19, lines 65-66.) However, Jaffe does not teach RMD CRTs being operated as a switch by turning the light completely on and completely off. The reason, which is well known to those skilled in the art, is that color intensity in CRTs is easily modulated by electron beam current and not by switching the electron gun on and off; as such, those skilled in the art would recognize that the devices using LCDs in Jaffe pertain to the non-CRT RMDs. In fact, Jaffe only asserts (1) RMD CRTs can be used in a direct view CRT display having electron guns and can be used in a CRT projection display having electron guns and (2) electron guns in CRTs produce electron beams "corresponding to the desired intensity of each color." (See col. 15, lines 27-35.) As such, if color intensity in a RMD CRT is

Serial No. 10/047,239

PU020018

controlled by the electron beam (which is known in the art to be beam current), then there is no need or motivation to modulate the light generated in the RMD CRT with liquid crystals. In fact, electron beam current is the most direct means to modulating color intensity. Therefore, following the teaching in Jaffe, one skilled in the art would not consider implementing an RMD CRT in an LCD device because Jaffe teaches (1) the use of other RMD types with LCD (i.e. electro-optic or piezo-electric type RMDs and plasma discharge type RMDs) and (2) the desired intensity modulation in RMD CRTs is adjusted by the electron beams without the need for modulation by the liquid crystals.

Applicants also point out that their "Description of Related Art" does indicate that current projection displays with LCOS technology lacks adequate light for illumination. However, the "Description of Related Art" does not suggest the coupling of any LCOS with a CRT light source for use in a projection device in the current art, and nor does it suggest the coupling of LCOS with an RMD CRT in a projection device in the current art. As such, one skilled in the art with knowledge of what is in Applicant's "Description of Related Art" and Jaffe would not look to make a projection display which is as complicated as coupling an LCOS device with an RMD CRT device, especially when Jaffe teaches away from combining RMD CRTs with LCDs in projection devices (per the above assertions regarding col. 15, lines 27-35, in Jaffe).

An additional point that Applicants respectfully assert is that neither Jaffe nor Applicants' "Description of Related Art" can be interpreted as teaching to have a RMD CRT source for an LCD or LCOS, because neither Jaffe nor Applicants' "Description of Related Art" assert that there is any prior art or precedence for even having a conventional CRT as a source for any LCD or LCOS. Applicants believe that there is no suggestion to even consider coupling a conventional CRT with an LCD or LCOS, because (1) CRTs themselves as a display produce excellent image resolution and definition and color intensity with a large dynamic range, and as such, an LCD or LCOS front-end is not necessary, and (2) it is well recognized in the display industry that there is a substantial trend to reducing the depth of displays, and as such, the fact that CRTs cause a display to have a large depth (due to the fact that CRTs must house electron guns, sockets, and some beam steering device) is causing the display industry to intentionally avoid the implementation of CRTs (or, in other words, phase out CRTs). Therefore, the

Serial No. 10/047,239

PU020018

display industry in looking for sources for LCDs and LCOSs would clearly avoid CRTs in general. This is especially true, because other sources having significantly lower depth are available.

In light of the above assertions that Jaffe does not disclose nor suggest all of the claimed limitations, Applicants believe that amended claim 1 is not obvious and is in condition for allowance.

Claim 3

Dependent claim 3 depends from amended claim 1 and includes all of the claim limitations in claim 1. The additional limitation in claim 3 is that the projection type display unit includes three LCOS imagers 212.

Because dependent claim 3 includes all of the limitations of the base claim 1, Applicants assert that claim 3 is patentable over the cited references in light of the remarks and assertions advanced for claim 1.

Regardless, Applicants respectfully point out that Jaffe does not teach in any embodiments the use of any LCOS or LCD imagers coupled RMD CRTs. Further, Jaffe does not show or state that it is possible to incorporate three different LCOS or LCD imagers in a projection display. In fact, Jaffe in col. 20, lines 46-61, states that for full color flat displays (i.e. LCD type displays): "Full color would be best generated by an array of microcavities consisting of alternating stripes in which each striped region is constructed to form one continuous resonant microcavity designed to generate one color." From this statement in Jaffe, one skilled in the art who happens to be motivated to incorporate an LCD imager with some type of an RMD of a projection display would look to the examples that Jaffe discusses with reference to LCDs. As such, one looking to these examples would be compelled to include one LCD imager (and not three), because Jaffe clearly states that it is "best" to have an RMD with an array of microcavities for full color. In other words, Jaffe teaches away from the use of three specific LCOS or LCD imagers.

In light of the above assertions, Applicants believe that claim 3 is not obvious and is in condition for allowance.

Claim 5

Applicants amend claim 5 to include additional limitations. Also, claim 5 depends from claim 3 and the amended base claim 1 and, therefore, includes all of the claim limitations in claims 1 and 3. Because dependent claim 5 includes all of the limitations of claim 3 and the base claim 1, Applicants assert that claim 5 is patentable over the cited references in light of the remarks and assertions advanced for claims 1 and 3.

Regardless, Applicants respectfully point out that dependent claim 5 is directed to a projection type display unit including three LCOS imagers 212; at least one red resonant microcavity cathode-ray tube 204, at least one green resonant microcavity cathode-ray tube 206, and at least one blue resonant microcavity cathode-ray tube 208; a projection lens 214; and an optical combiner. (See Applicants' specification at Fig. 2; page 5, lines 11-23; page 6, lines 1-7; and page 7, line 25 to page 8, line 9.) The red, green, and blue resonant microcavity cathode-ray tubes 204, 206, 208 emit red, green, and blue light and each of these resonant microcavity cathode-ray tubes 204, 206, 208 is optically coupled to three corresponding imager 212 to produce three distinct color images. (See Applicants' specification at Fig. 2 and page 7, line 28 to page 8, line 9.) The optical combiner 214 (which is represented by the rectangle having reference sign 214) merges the three distinct color images to form a single composite image. (See Applicants' specification at Fig. 2; page 6, lines 6-8; and page 8, lines 7-9.) The projector lens 214 (which is represented by the 8-sided polygon in Fig. 2) is optically coupled to the imagers 212 for magnifying and focusing the images for projection on a screen. (See Applicants' specification at Fig. 2; page 8, lines 5-9.) The additional subject matter that Applicants add to claim 5 is (1) electron emitters in the resonant microcavity cathode-ray tubes and (2) electron beams from the electron emitters being diffuse such that the resonant microcavity cathode-ray tubes do not form an image directly." (See Applicants' specification on page 6, lines 20-23.)

Jaffe clearly does not teach nor suggest the novel combination of features in amended claim 5. In particular, the feature of the electron beam being diffuse is interpreted to mean that the electron beam size is so large that the resolution of resonant microcavity cathode-ray tubes is too low to form a well-defined image. In other words,

Serial No. 10/047,239

PU020018

the electron beams being diffuse means that the electron beam spot size is larger than the dimensions of a pixel.

In sharp contrast, Jaffe teaches RMD CRTs which have non-diffused electron beams. Jaffe asserts in col. 15, lines 58-62, that RMD CRTs meet high definition television applications required for medical and military uses, which means that the electron beams are not diffuse. (The reason, which is well known by those in the art, is high-definition requires that the electron beams must have good resolution and cannot be diffuse, because if the beams become larger than that of a given pixel, objects in a given screen which are supposed to have sharp edges can have fuzzy edges and color contrast will be diminished in locations of a screen where there is supposed to be a color transition.) Further in support of Applicants' assert that Jaffe only teaches non-diffuse electron beams in RMD CRTs, Applicants respectfully assert that Jaffe in Figs. 13a and 13b shows a screen structure for an RMD CRT, wherein each of the blocks is a pixel-sized microcavity 20. (See Jaffe, col. 15, lines 36-45.) Here, Jaffe must specifically teach away from the use of diffuse beams in RMD CRTs, because otherwise portions of the electron beams from the red, green, and blue electron guns would land on the other phosphor colors and cause color purity errors.

In light of the fact that Jaffe does not disclose any electron beams in RMD CRTs that are diffuse and Applicants' assertions of other combinations of claimed elements in claim 5 not being disclosed in Jaffe, Applicants request reconsideration of claim 5.

Claim 9

Independent claim 9 is directed to a method for displaying an image which includes the steps of providing three CRT resonant microcavities 202, 204, and 206 for emitting red, green and blue light; projecting red, green and blue light through cells of an LCOS imager 212; and magnifying and focusing the image through a lens 214 (which is represented by the 8-sided polygon in Fig. 2) for projection on a screen. (See Applicants' specification at Fig. 2; page 5, lines 11-26; page 6, lines 1-6; and page 7, line 28 to page 8, line 9.) In the projecting step, each cell comprises a pixel of an image and each pixel is individually controlled by video signal to produce the image. (See Applicants' specification at 5, lines 11-14; page 5, lines 22-23; and page 7, line 28 to page 8, line 9.)

Serial No. 10/047,239

PU020018

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In light of the fact that Jaffe does not disclose any electron beams in RMD CRT's that are diffuse and Applicants' assertions of other combinations of claimed elements in claim 5 not being disclosed in Jaffc, Applicants request reconsideration of claim 5.

Claim 9

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As pointed out above, Jaffe describes numerous types of resonant microcavity displays (RMDs) and generally characterizes RMDs as "any structure that modifies spontaneous emission properties of a phosphor contained within the structure ..." such that it is "possible to suppress emission in certain optical modes ..." and "the phosphor favorably emits into a relatively few optical modes...." (See Jaffe at col. 4, lines 48-59.) Jaffe discloses that the phosphor in RMDs "may be excited through several means including: bombardment by externally generated electrons (cathodoluminescence), excitation by electrodes placed across the active layer to create an electric field (electroluminescence), or excitation using photons (photoluminescence). (See Jaffe at col. 5, line 65 to col. 6, line 3.)

As pointed out above, Jaffe discloses 21 different embodiments of RMDs according to the invention therein. These embodiments are generally described in Figs. 1-10 and 12-23 and in col. 7, line 58 to col. 9, line 4. One embodiment of the invention is shown in each of the following figures in Jaffe: Figs. 1-7 and 10 and Figs. 14-23. Figs. 8 and 9 together show one embodiment. Figs. 12, 13a and 13b together show one embodiment.

In Jaffe, the only examples of RMDs which are characterized as being usable in CRTs are the ones showing the monochromatic CRT 100 in Figs. 8-9 (col. 14, lines 45-53) and showing the full color CRT 120 in Fig. 12-13b (see col. 15, lines 27-45). In Jaffe, the CRT 120 in Fig. 12 is described as being used in direct view television. (See Jaffe, col. 15, lines 27-35.) It is only these two RMDs 100, 120 that have any relevance to Applicants' invention, because these are the only RMDs that have electron guns and scan electron beams on a screen. All other RMDs disclosed in Jaffe are completely different RMD types, and as such, are irrelevant to Applicants' claimed invention. The other RMDs are completely different devices than RMD CRTs, because they do not have electron guns and they are generally addressed, as opposed to scanning electron beams. (The RMD shown in Fig. 21 of Jaffe and discussed in col. 19, lines 7-10, scans a laser beam.)

Applicants' claim 9 includes, *inter alia*, the steps of
"providing three CRT resonant microcavities configured for emitting red, green and blue color light, respectively;

projecting said color red, green and blue light through cells of an LCOS imager, each cell comprising a pixels of said image, each pixel individually controllable by video signal, thereby producing said image.”

Jaffe does not disclose a display unit that provides in the combination three RMD CRTs that project light through the cells of an LCOS imager to produce an image on a screen. Rather, Jaffe points out (1) that conventional full color projection televisions require three separate CRTs for each primary color and (2) RMD CRTs (resonant microcavity cathode-ray tube) are superior CRTs because they allow intense excitation and compact CRTs. (See Jaffe, col. 13, lines 13-19.) As such, Jaffe asserts that RMD CRTs can replace CRTs as the source in CRT projection displays, because an RMD CRT “allows for intense excitation loading of the phosphor, highly directional output, controlled chromaticity, and high external efficiency.” In other words, with reference to CRTs, Jaffe does not assert the coupling of RMD CRTs (resonant microcavity cathode-ray tubes) with any LCD or LCOS device, but rather is asserting that RMD CRTs are superior to conventional CRTs.

Further, the only LCD devices incorporating RMDs in Jaffe are flat panel displays. (See Jaffe, col. 20, lines 53-56.) Flat panel displays in this context are direct view LCD panels, and not projection displays. In fact, an example LCD device given by Jaffe teaches the use of RMDs that are not RMD CRTs, but are, instead, electro-optic or piezo-electric type RMDs shown in Fig. 22 of Jaffe (col. 19, line 56 to col. 20, line 5) and plasma discharge type RMDs shown in Fig. 23 of Jaffe (col. 21, lines 21-34). Electro-optic or piezo-electric type RMDs and plasma discharge type RMDs are completely different than RMD CRTs (which is a limitation in Applicants' amended claim 1) and the electro-optic or piezo-electric type RMDs and plasma discharge type RMDs should be thinner than RMD CRTs, because RMD CRTs need extra depth (1) so that the glass vacuum tube can house an electron gun (col. 14, lines 45-53) and (2) so that the CRT can scan “an electron beam to write the information to the luminescent screen.” (See Jaffe, col. 4, lines 32-34.)

Applicants further point out that Jaffe teaches the use of light valves (such as those used in LCDs) to modulate light intensity generated by RMDs that operate as “a switch by turning the light completely on and completely off.” (See Jaffe, col. 19, lines

Serial No. 10/047,239

PU020018

65-66.) However, Jaffe does not teach RMD CRT's being operated as switch by turning the light completely on and completely off. Those skilled in the art know that color intensity in CRTs is easily modulated by electron beam current and not by switching the electron gun on and off; as such, those skilled in the art would recognize that the devices using LCDs in Jaffe pertain to the non-CRT RMDs. In fact, Jaffe only asserts (1) RMD CRT's can be used in a direct view CRT display having electron guns and can be used in a CRT projection display having electron guns and (2) electron guns in CRTs produce electron beams "corresponding to the desired intensity of each color." (See col. 15, lines 27-35.) As such, if color intensity in a RMD CRT is controlled by the electron beam (which is known in the art to be beam current), then there is no need or motivation to modulate the light generated in the RMD CRT with liquid crystals.. In fact, electron beam current is the most direct means to modulating color intensity. Therefore, following the teaching in Jaffe, one skilled in the art would not consider implementing an RMD CRT in an LCD device because Jaffe teaches (1) the use of other RMD types with LCDs (i.e. electro-optic or piezo-electric type RMDs and plasma discharge type RMDs) and (2) the desired intensity modulation in RMD CRTs is adjusted by the electron beams without the need for modulation by the liquid crystals.

Applicants also point out that their "Description of Related Art" does indicate that current projection displays with LCOS technology lacks adequate light for illumination. However, the "Description of Related Art" does not suggest the coupling of any LCOS with a CRT light source for display devices in the current art nor does it suggest the coupling of LCOS with an RMD CRT in a projection device in the current art. As such, one skilled in the art with knowledge of what is in Applicant's "Description of Related Art" and Jaffe would not look to make a display which is as complicated as coupling an LCOS device with an RMD CRT device, especially when Jaffe teaches away from combining RMD CRTs with LCDs in projection devices.

An additional point that Applicants respectfully assert is that neither Jaffe nor Applicants' "Description of Related Art" can be interpreted as teaching to have a RMD CRT source for an LCD or LCOS, because neither Jaffe nor Applicants' "Description of Related Art" assert that there is any prior art or precedence for even having a conventional CRT as a source for any LCD or LCOS. Applicants believe that there is no

Serial No. 10/047,239

PU020018

suggestion to even consider coupling a conventional CRT with an LCD or LCOS, because CRTs themselves as a display produce excellent image resolution and definition and color intensity with a large dynamic range, and as such, an LCD or LCOS front-end is not necessary and (2) it is well recognized in the display industry there substantial trend to reducing the depth of displays, and as such, the fact that CRTs cause a display to have a large depth (due to the fact that CRTs must house electron guns, sockets, and some beam steering device) is causing the display industry to intentionally avoid the implementation of CRTs. Therefore, the display industry in looking for sources for LCDs and LCOSs would clearly avoid CRTs in general. This is especially true, because other sources having significantly lower depths are available.

In light of the above assertions (i.e. Jaffe not including nor suggesting all of the claimed limitations), Applicants believe that amended claim 9 is not obvious and is in condition for allowance.

Claim 10

Dependent claim 10 depends from claim 9 and includes all of the claim limitations in claim 9. The additional limitation in claim 10 is that the display unit includes the step of optically combining two individual distinct color images from at least two LCOS imagers 212.

Because dependent claim 10 includes all of the limitations of the base claim 9, Applicants assert that claim 10 is patentable over the cited references in light of the remarks and assertions advanced for claim 9.

However, Applicants point out that dependent claim 10 is directed to a method for displaying an image which includes the steps of providing three CRT resonant microcavities 202, 204, and 206 for emitting red, green and blue light; projecting red, green and blue light through cells of an LCOS imager 212; and magnifying and focusing the image through a lens 214 (which is represented by the 8-sided polygon in Fig. 2) for projection on a screen. (See Applicants' specification at Fig. 2; page 5, lines 11-26; page 6, lines 1-6; and page 7, line 28 to page 8, line 9.) In the projecting step, each cell comprises a pixel of an image and each pixel is individually controlled by video signal to produce the image. (See Applicants' specification at 5, lines 11-14; page 5, lines 22-23;

Serial No. 10/047,239

PU020018

and page 7, line 28 to page 8, line 9.) Dependent claim 10 includes a step of optically combining distinct color images at least two imagers. (See Applicants' Fig. 2 and specification at page 6, lines 1-12 and original claim 10.)

Applicants point out that actually Jaffe teaches away from optically coupling distinct color images from different color imagers. The reason is that (1) Jaffe does not teach nor suggest the use of three LCD or LCOS imagers; (2) Jaffe in col. 20, lines 46-61, states that for full color flat displays (i.e. LCD type displays) "would be best generated by an array of microcavities consisting of alternating stripes in which each striped region is constructed to form one continuous resonant microcavity designed to generate one color." From this statement in Jaffe, one skilled in the art who happens to be motivated to incorporate an LCD imager with some type of an RMD of a projection display would look to the examples that Jaffe discusses with reference to LCDs. As such, one looking to these examples would be compelled to include one LCD imager (and not three), because Jaffe clearly states that it is "best" to have an RMD with an array of microcavities for full color.

In light of the above assertions (i.e. Jaffe does not teach three LCD or LCOS imagers and Jaffe does not teach the coupling of RMD CRTs with liquid crystal), Applicants believe that amended claim 10 which includes such limitation is not obvious and is in condition for allowance.

Oath/Declaration

Item 3

A properly signed oath or declaration is being executed and will soon follow.

Conclusion:

In view of the arguments presented herein, the application is considered to be in condition for allowance. Reconsideration and passage to issue is respectfully requested. If the Examiner has any questions or comments that would facilitate the disposition or

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Serial No. 10/047,239

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PU020018

resolution of the issues, he is respectfully requested to contact the undersigned at 717-295-6207.

Please charge any additional fees not already indicated in the fee transmittal form associated with this application to Deposit Order Account No. 07-0832.

Respectfully submitted,
Eugene Murphy O'Donnell and still Thone Hall,
Jr., Applicants



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